

Remarks

Please consider the following remarks.

Support for the amendments to claims 1, 4, 6 and 7 can be found on pages 3 and 4 of the specification. Paragraph 2 of page 3 sets forth that the ionic liquid can comprise, consist of or consist essentially of a cation and an anion, and the first full paragraph of page 4 states that the anion is selected from the group consisting of halides of: Group IIIA metals, copper, zinc, iron, phosphorus and combinations thereof. Thus, the anion can comprise, consist essentially of, or consist of any combination of the Markush group members set out above.

The Examiner has required restriction of the claims to one of the following inventions under 35 U.S.C. 121:

- I. Claims 1 – 11, drawn to a supported catalyst, classified in class 502, subclass 164 at seq.
- II. Claims 12 – 29, drawn to a process of converting a hydrocarbon feed stream into C4 and C6 products, classified in class 585, subclass 708.

Applicants elect, with traverse, claims 1 – 11 of invention I, affirming the provisional election made by the undersigned on February 11, 2005. However, Applicants respectfully request reconsideration and withdrawal of the restriction requirement for the following reasons.

Since a thorough search of the invention would necessarily include all the art classifications cited by the Examiner, examination of all the claims and the merits would impose no additional burden on the Patent Office. Therefore, it is requested that the Examiner's restriction requirement be withdrawn. Additionally, Applicants respectfully request the Examiner to use his discretion to examine this application on its merits, even though it may include claims to distinct or independent inventions. The Examiner is granted authority under 35 U.S.C. § 121 to make a restriction requirement when two or more independent and distinct inventions are claimed in one application.

However, the language in § 121 is permissive and not mandatory upon the Commissioner, thus, allowing the Commissioner discretion in the making of a restriction requirement. Applicants respectfully request that the restriction requirement be withdrawn and that claims 12 – 29 be examined with opportunity to amend.

Objections

In response to the Examiner's objections to claims 6, 10 and 11, claim 6, as amended, no longer includes the term "Group IIIA", and has been amended to include, in two locations, the phrase "the group consisting of", as suggested by the Examiner. In addition, claims 10 and 11 have been amended to replace the term "Group VIII" with the term -- Group 8-10 (VIII) --, in response to the Examiner's suggestion.

Rejections

The Examiner has rejected claims 1 and 7 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 has been amended to include the term -- porous -- before the term "support", as suggested by the Examiner. With regard to the rejection of claim 7, Applicants point out that the recitation in question which was originally contained in claim 6, has been added to claim 1 and amended to read "wherein said anion consists essentially of halides of elements selected from the group consisting of: Group 13 (IIIA) metals, zinc, iron and phosphorus, and combinations thereof", and that tetrafluoroborate is certainly a halide of the Group 13 metal "boron". Thus, Applicants respectfully request reconsideration and withdrawal of this rejection.

The Examiner has rejected claims 1 – 5 under 35 U.S.C. 102(b) as being anticipated by Benazzi et al., USP 5,693,585.

Benazzi discloses a catalyst which includes a porous organic or mineral support, preferably silica, and at least one active phase containing at least one aluminum halide, at least one amine hydrohalide, preferably an amine hydrochloride or hydrobromide, and/or at least one quaternary ammonium halide, and at least one Cu(I) compound. Benazzi also discloses that the support is impregnated by at least one active phase which is ionic complex which is not miscible with the hydrocarbon phase, commonly known as a molten salt. See Bennazi, Col. 2, lines 15 – 24. Benazzi also discloses in Col. 3, lines 64 – 65 that “[a]n essential feature of the invention is the presence of copper (I) in the active phase on the support.” In addition, the organic or mineral support, preferably silica, is generally such that, before impregnation by the acid phase, the specific surface area is in the range $0.1 \text{ m}^2/\text{g}$ to $1500 \text{ m}^2/\text{g}$, and its total pore volume is in the range $0.1 \text{ cm}^3/\text{g}$ to $6 \text{ cm}^3/\text{g}$. See Bennazi, Col. 4, lines 33 – 36.

Applicants submit that claims 1 – 5, as amended, are patentably distinct over Benazzi. Benazzi requires the presence of at least one cuprous compound (the anion of the ionic liquid), and claims 1 and 4 have been amended such that the anion either consist essentially of or consists of a halide or halides of a group of elements not including copper.

Applicants also submit that claims 1 – 5 are patentably distinct over Benazzi in that Benazzi does not recognize the importance of having an average pore diameter greater than about 225 angstroms. The Examiner has used a formula from the Furtek et al. USP 5,118,648 to calculate the pore diameter from the pore volume and surface area as given in Benazzi. Based on this formula, and the disclosures in the Benazzi reference, the average pore diameter for the supports disclosed in Benazzi can range from around 2.67 angstroms to about 2,400,000 angstroms. The inventive catalysts of the Benazzi reference prepared in Examples 1, 3 and 7 used different silica supports having average pore diameters, as calculated using the formula from the Furtek patent, of 253, 210,

and 38 angstroms, respectively. Thus, the Benazzi patent did not recognize any distinction between a support having as low as a 38 angstrom average pore diameter up to a support having an average pore diameter of 253 angstroms. Applicants discovered an unexpected sharp rise in isopentane conversion when the silica support average pore diameter is greater than about 225 angstroms.

The Examiner's attention is drawn to Table II of the specification (on page 7) which shows that the isopentane conversion using control support A, with an average pore diameter of 164 angstroms, resulted in only 30.5 weight percent conversion of isopentane, whereas the isopentane conversion for the inventive runs using supports B1 (372 angstroms), B2 (308 angstroms) and B3 (228 angstroms) resulted in isopentane conversions of 76.0, 72.2 and 53.5 weight percent, respectively. As set out in the MPEP on pages 2100-76 to 2100-77 in section 2131.03 II., "[i]n order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." Such section also states that, with evidence of unexpected results, the claimed narrow range may be found to have not been disclosed with "sufficient specificity" to constitute an anticipation of the claims by a reference which teaches a broad range. Applicants submit that the limitation that the average pore diameter is greater than about 225 angstroms represents a sufficiently narrow range, and, coupled with the clear evidence of unexpected results for use of a support including this average pore diameter range of greater than about 225 angstroms, Applicants submit that such evidence reasonably supports the conclusion that this narrow range is not disclosed with "sufficient specificity" to constitute anticipation of the claims by the Benazzi reference.

The Examiner has rejected claims 1 – 9 under 35 U.S.C. 103(a) as being unpatentable over Benazzi as cited above. The arguments set out above regarding the rejection of claims 1 – 5 based

on 35 U.S.C. 102(b) apply equally to this rejection under 35 U.S.C. 103(a). In particular, Applicants submit that claims 1 – 9, as amended, are patentably distinguishable over the Benazzi reference.

The Examiner has rejected claims 1 – 11 under 35 U.S.C. 103(a) as being unpatentable over Benazzi in view of Welton, Chem. Rev. 1999, Vol. 99, pp. 2071-2083.

Welton discloses the use of a rhodium compound with an ionic liquid for use in hydrogenation reactions, for example, the hydrogenation of pent-1-ene and cyclohexene. The Benazzi reference, on the other hand, is directed to the use of its ionic liquid catalyst for the alkylation of hydrocarbons. Thus, Applicants submit that one of ordinary skill in the art would likely suspect that the addition of the rhodium (Group III) metal to the catalyst of the Benazzi reference could frustrate the alkylation reaction by possibly causing hydrogenation of the olefins in the feedstream. At a minimum, it is not at all clear that one of ordinary skill in the art would be motivated, upon reading the Benazzi reference, to seek out the addition of a Group VIII metal as disclosed by Welton for use in hydrogenation reactions, in order to enhance the alkylation activity of its catalyst. The Examiner has not shown sufficient motivation within Benazzi to seek out the Welton reference for incorporation of a Group VIII metal into the Benazzi catalyst. Thus, Applicants respectfully request reconsideration and withdrawal of this rejection.

In view of the amendments to claims 1, 4, 6, 7, 10 and 11, and the remarks above, claims 1 – 11 are now believed to be in condition for allowance. Therefore early allowance for claims 1 – 11 is respectfully requested.

Respectfully submitted,
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